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Cyclical Fiscal Policy, Credit Constraints, and Industry Growth

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Abstract

What are the effects of cyclical fiscal policy on industry growth? We show that industries with a relatively heavier reliance on external finance or lower asset tangibility tend to grow faster (in terms of both value added and of labor productivity growth) in countries that implement fiscal policies that are more countercyclical. We reach this conclusion using Rajan and Zingales' (1998) difference-in-difference methodology on a panel data sample of manufacturing industries across 15 OECD countries over the period 1980–2005.

Keywords: Growth, Financial Dependence, Fiscal Policy, Countercyclicality

JEL classification: E32, E62

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1. Introduction

Standard macroeconomic textbooks generally separate the analysis of long-run growth from that of short-term growth. Long-run growth is linked to structural characteristics of the economy (education, R&D, openness to trade, financial development) while the short-term analysis emphasizes the short-term effects of supply or demand shocks and the effects of macroeconomic policies (fiscal and/or monetary) aimed at stabilizing the economy. Yet the view that short-run stabilization policies should have no significant impact on long-run growth has been challenged by several empirical papers, notably Ramey and Ramey (1995), who find a negative correlation in cross-country regression between volatility and long-run growth.[1] More recently, using a Schumpeterian growth framework, Aghion et al (2010) have argued that higher macroeconomic volatility affects the composition of firms' investments and, in particular, pushes towards more procyclical R&D investments in firms that are more credit-constrained.

This paper takes a further step by analyzing the effect of stabilizing fiscal policy on (industrial) growth, and how this effect depends upon the financial constraints faced by the industry. The first part of the paper builds on Aghion et al (2010) to sketch the theoretical argument that rationalizes our empirical strategy and predictions. In this framework, firms can invest either in short-run projects, or in productivity-enhancing long-term projects (e.g. R&D investments). Short-term projects face an aggregate productivity shock while the completion of long-term innovative projects is subject to a liquidity risk: such projects fail to deliver output and increase knowledge if some reinvestment is not carried out during the interim period. Reinvestment needs can then be met using output from short-term projects and/or through borrowing on the capital market. Yet because of credit market imperfections, a fraction of firms in the industry can only use retained earnings to meet their reinvestment needs.

[1] Additional evidence can be found in Bruno (1993) on inflation and growth or more recently, Imbs (2007).

Then if credit market imperfections bind only in the low state of the world, reducing the volatility of aggregate shocks increases the likelihood that long-term projects survive liquidity shocks in the bad state without affecting what happens in the good state where credit constraints do not bind. Moreover, the higher the fraction of credit constrained firms, the larger the positive effect from reducing aggregate volatility on the equilibrium fraction of long-term projects that survive liquidity shocks. A countercyclical fiscal policy that reduces aggregate volatility should therefore have a positive impact on the growth rate of more credit-constrained industries.[2]

The second part of the paper takes this prediction to the data. Departing from the existing empirical literature on volatility and growth, which relies mainly on cross-country regressions, the paper follows the methodology developed in Rajan and Zingales (1998). We use cross-country/cross-industry panel data on a sample of 15 OECD countries over the period 1980–2005, to test whether industry growth is significantly affected by the interaction between fiscal policy countercyclicality (computed for each country) and external financial dependence or asset tangibility (measured for the corresponding industry in the US). Figure 1 summarizes our main findings: it plots value added growth for a set of manufacturing industries as a function of total fiscal balance to potential GDP countercyclicality, controlling for initial industry size. The left-hand panel in Figure 1 depicts this relationship for industries with below-median levels of financial dependence, whereas the right-hand panel plots this relationship for industries with above-median levels of financial dependence.[3] A more

[2] See Aghion et al (2011) for firm-level evidence of an asymmetric effect of credit constraints on R&D over a firm's business cycle.

[3] More precisely, the estimated equation is $\mathrm{g}_{i,c} = \alpha_i + \beta \mathrm{fp}_c - \delta \log \mathrm{y}_{i,c} + \varepsilon_{i,c}$, where $\mathrm{g}_{i,c}$ is the average growth in real value added in industry i in country c for the period 1980–2005, α_i is a full set of industry dummies, fp_c is fiscal policy countercyclicality (here, the output gap sensitivity of total fiscal balance to potential GDP) for the period 1980–2005, $\mathrm{y}_{i,c}$ is the ratio of value added in industry i in country c to total manufacturing valued added in country c in 1980. Parameters for estimation are α_i, β and δ, while $\varepsilon_{i,c}$ is a residual. This equation is estimated separately for industries with below-median financial dependence and with above-median financial dependence. For the former, the estimated coefficient β is $-.25$ and is insignificant at standard confidence levels. For the latter, the estimated coefficient β is 2.32 and is significant at standard confidence levels (5% level).

countercyclical fiscal policy has virtually no effect on value added growth for industries with below-median levels of financial dependence, i.e. those that face milder credit constraints. On the contrary, a more countercyclical fiscal policy has a positive and significant impact on real value added growth for industries with above median-levels of financial dependence, i.e. with tighter credit constraints. Using the same methodology, a similar type of result can be derived by decomposing the sample between industries with below-median asset tangibility from industries and above-median asset tangibility.

The empirical analysis in this paper aims at establishing the robustness of these findings. The empirical results can be summarized as follows. First, fiscal policy countercyclicality – measured as the sensitivity of a country's total or primary fiscal balance (relative to GDP) to time variations in its output gap – has a more positive and significant impact on industry growth the higher the corresponding US industry's reliance on external finance, or the lower its degree of asset tangibility. This result holds whether industry growth is measured by real value added growth or by labor productivity growth. Moreover, the effect of the interaction between industry financial constraints and countercyclical fiscal policy on growth is stronger and more significant in slumps than in booms, which in turn echoes the asymmetry between good and bad states emphasized in the theoretical argument.

One can then assess the magnitude of the corresponding difference-in-difference effect, i.e. how much extra growth is generated when fiscal policy countercyclicality and financial constraints move from the first to the third quartile. The figures happen to be relatively large, especially when compared to the equivalent figures in Rajan and Zingales (1998). This, in turn, suggests that the effect of a more countercyclical fiscal policy in more financially constrained industries is economically significant. Next, we show that our baseline result is robust to: (i) adding control variables such as financial development, inflation, and average fiscal balance interacted with the industry measures of financial constraints; (ii) taking into account the uncertainty around fiscal policy cyclicality estimates; (iii) instrumenting fiscal policy cyclicality with economic, legal and political variables.[4]

What is gained by moving from cross-country to cross-industry analysis? A pure cross-country analysis raises at least three issues. First, the cyclicality of fiscal policy is typically captured by a unique time-invariant parameter which only varies across countries. As a result, standard cross-country panel regression cannot be used to assess the effect of the cyclical pattern of fiscal policy on growth inasmuch as the former is perfectly collinear to the fixed effect that is traditionally introduced to control for unobserved cross-country heterogeneity.[5] Second, the causality issue (does fiscal policy cyclicality have an impact on growth or does growth affect the cyclical pattern of fiscal policy) cannot be properly addressed while keeping the analysis at a purely macroeconomic level.[6] A final concern is identification: a cross-country panel regression, particularly one which is restricted to a small cross-country sample, is unlikely to be robust to the inclusion of additional control variables reflecting alternative stories. Thus, even if cross-country panel regressions point to correlations between the cyclical pattern of fiscal policy and growth, the channel through which this correlation works is unlikely to be well identified.

Our industry-level analysis helps us address these concerns. First, even though the countercyclicality of fiscal policy is estimated at the country level with a time-invariant coefficient, which implies that fiscal policy countercyclicality in each country is collinear to that country's fixed effect, the interaction between the country-level measure of countercyclicality and the industry level variable is not. Second, at the cross-industry level, there are enough observations to ensure that the results withstand the introduction of country and industry fixed effects plus a whole set of structural variables as additional controls. Finally, macroeconomic

[4] Other robustness checks have been carried out but are not presented here for the sake of brevity. These have included, for example, the use of alternative measures of fiscal policy cyclicality.

[5] To overcome this problem, Aghion and Marinescu (2007) introduce time-varying estimates of fiscal policy cyclicality. While this helps to control for unobserved heterogeneity, it comes at the cost of losing precision in the estimates of fiscal policy cyclicality.

[6] One particular reason for this is that fiscal policy cyclicality is used in growth regressions as a right-hand side variable while the estimation of time-varying fiscal policy cyclicality requires the full data sample to be used. See Aghion and Marinescu (2007).

policy should affect industry-level growth whereas the opposite – industry-level growth affecting macroeconomic policy – is less likely to hold. Thus, the presence of a positive and significant interaction coefficient in the industry-level regressions is more likely to reflect a causal impact of the cyclical pattern of fiscal policy on growth.[7] However, there is a downside to the industry-level investigation: namely, that our cross-country/cross-industry differences-in-differences analysis has little to say about the aggregate magnitude of the macroeconomic growth gain/loss induced by different patterns of cyclicality in fiscal policy.[8]

The analysis in this paper contributes to at least three ongoing debates among macroeconomists: 1) is there a (causal) link between volatility and growth?; 2) what is the rationale for pursuing a countercyclical fiscal policy; and 3) what are the effects of a countercyclical fiscal stimulus on aggregate output? On the first aspect, Acemoglu and Zilibotti (1997) stress that the correlation between long-term growth and volatility is not entirely causal, pointing to low financial development as a factor that could both reduce long-run growth and increase the volatility of the economy. More recently, Acemoglu et al (2003) and Easterly (2005) hold that both high volatility and low long-run growth arise not directly from policy decisions but rather from bad institutions. However, fiscal policy cyclicality varies significantly even among OECD countries (Lane, 2003) that share similar institutions. And our own finding also speaks to the importance of cyclical fiscal policy, over and above the effect of more structural variables. As mentioned previously, Aghion et al (2010) defend the view that higher volatility should induce lower growth by discouraging long-term growth-enhancing investments, particularly in more credit-constrained firms. Aghion et al (2009) build on that insight when analyzing the relationship between long-run growth and the choice

[7]Fiscal policy cyclicality could depend on the industry composition of total output if, for example, industries that benefit more from a countercyclical fiscal policy countercyclicality lobby more intensely for such a policy. However, to the extent that there are decreasing returns to scale (which is likely to be the case in the manufacturing industries featured in our empirical analysis), this would rather imply a downward bias in our estimates of the positive impact of fiscal policy countercyclicality on growth. Hence, controlling for this possible source of endogeneity would only reinforce our conclusions by reducing this downward bias.

[8]The fact that we focus on manufacturing industries, and leave out the service sector makes it even harder to use our results to derive more aggregate numerical conclusions.

of exchange-rate regime.[9]

On the second aspect, the case for a countercyclical fiscal policy was most forcefully made by Barro (1979): it helps smooth out intertemporal consumption when production is affected by exogenous shocks, thereby improving welfare. Another justification for countercyclical fiscal policy stems from a more Keynesian view of the cycle: namely, to the extent that a recession corresponds to an increase in the inefficiency of the economy, appropriate fiscal or monetary policy that raises aggregate demand can bring the economy closer to the efficient level of production (see Galí et al, 2007). The effect of fiscal policy in our framework is different: a countercyclical fiscal policy, by reducing aggregate volatility can induce firms to devote more investment to long-term projects, as innovations will then pay out more.

Finally, an extended literature looks at the – short-run – output response to an exogenous increase in government spending or to a tax cut. Importantly in these papers, GDP is usually detrended, so that all long-run effects are shut down. Although most economists would agree that a fiscal shock should increase short-run output, there is no consensus on the magnitude of the effect.[10] In particular, papers that introduce rational expectations and long-run wealth effects will typically predict a lower value of the multiplier (based on the idea that consumers anticipate that an increase in government spending today is likely to result in an increase in taxes tomorrow).[11] The paper moves beyond this debate by looking only at the long-run effect of a more countercyclical fiscal policy: even if the short-run effect

[9]See Aghion et al. (1999) and Aghion and Howitt (2009, ch14) for more complete literature reviews on the link between volatility and long-run growth.

[10]Skeptical views on the importance of the effect of fiscal shocks include Mountford and Uhlig (2009) or Perotti (2005). On the other hand, Fatás and Mihov (2001) find that an increase in government spending induces increases in consumption and employment. Romer and Romer (2010) find that exogenous tax increases are highly contractionary. Blanchard and Perotti (2002) show that both increases in government spending and tax cuts have a positive effect on GDP, but that fiscal policy shocks have a negative effect on investment; this does not contradict our theory which points at investments being directed towards more productivity enhancing projects as the channel whereby long-run growth is enhanced by a more countercyclical fiscal policy.

[11]For example Cogan et al (2010) compute the effect of a permanent increase in government expenditure by 1% of GDP as of 2009: by 2011 Q4, they find that the increase in GDP is only equal to 0.44%, whereas Romer and Bernstein (2009) find a 1.57% increase.

of a more countercyclical policy were more in line with the prediction of low multipliers, our results point to economically significant long-run effects.

The remaining part of the paper is organized as follows. Section 2 presents the outline of the argument for our main prediction. Section 3 describes the econometric methodology and the data sources used in our estimations. Section 4 presents our empirical results. Section 5 discusses their robustness. Section 6 concludes.

2. The argument in a nutshell

The argument can be formulated using a toy version of the model in Aghion et al (2010). Consider a dynamic economy in discrete time populated by a continuum of two-period lived entrepreneurs of mass 1. Let us denote by T_t the knowledge level at date t. Productivity A_t at date t is given by $A_t = a_t T_t$, where a_t is random variable with support $\{\underline{a}, \overline{a}\}$ where the high value $\overline{a}$ represents a good productivity shock (high state) whereas the low value $\underline{a}$ represents a bad productivity shock (low state).

Entrepreneurs are risk-neutral and consume only in the last period of their lives. Each entrepreneur born at date t is endowed with the same initial wealth $W_t = wT_t$ which she can allocate between a short-run capital investment, $K_t = kT_t$ and a long-term growth-enhancing (e.g. R&D) investment $Z_t = zT_t$, so that $w = z + k$.

Entrepreneurs decide on the amount of short-term and long-term investment before the state of the world is revealed. The short-run investment yields profits $\Pi_t = a_t \pi(k) T_t$ at the end of the first period, whereas the long-term growth-enhancing investment yields a long-term $v_{t+1} T_t$ with probability λz in the second period provided the entrepreneur survives a liquidity shock $C_t = \widetilde{c} T_t$ occurring at the end of the first period. These liquidity shocks are idiosyncratic, i.e. some entrepreneurs are lucky and only need to cover a low realization of the liquidity cost C_t, whereas other entrepreneurs are less lucky and must incur a high realization of C_t. Ex ante, entrepreneurs face the same uncertainty over the realization of $\widetilde{c}$, and for simplicity $\widetilde{c}$ is uniformly distributed over the interval $[0,1]$.[12]

In the absence of credit constraints, firms can borrow up to the net present value of their (long-term) profits. Hence, if v_{t+1} is sufficiently large, firms can always cover their liquidity costs and survive into the second period $t+1$. Let us assume, however, that only a fraction μ of firms have access to capital markets, the other firms need to refinance their project using their own cash-flow only, so that for these firms only a fraction f_t of the projects survive the liquidity shock, with $f_t = \Pr(a_t\pi(k) \geq \widetilde{c}) = \min\left(a_t\pi\left(k\right),1\right)$. Think of the variable μ as capturing the fraction of firms with highly tangible assets or with low reliance on external finance: thus the higher μ, the less firms in the sector are prone to be credit-constrained.

Firms learn whether they have access to the financial markets before they make their investment. Since long-term projects always survive the liquidity shock for firms with access to the financial market (we refer to those as "unconstrained firms") unlike the other ("constrained") firms, the former will invest more in long-term projects than the latter. Denote z_{nc} and z_c the levels of investment in long-term projects respectively by unconstrained and constrained firms in equilibrium: these investment levels then satisfy $z_{nc} > z_c$.

Finally knowledge growth from one period to the next depends on the fraction of long-term projects that survive the liquidity shocks. Namely:

$$\ln T_{t+1} - \ln T_t = \lambda\left(\mu z_{nc} + (1-\mu)\, z_c \min\left(a_t\pi\left(w - z_c\right),1\right)\right). \tag{1}$$

where λz is the innovation rate of a surviving firm that has allocated z to long-term investment at the beginning of the first period.

Let us restrict attention to aggregate shocks realizations $(\underline{a}, \overline{a})$ such that the credit constraint does not bind for $a_t = \overline{a}$. In that case, one can easily show that a mean preserving

[12]The analysis in this section extends straighforwardly to more general continuous distributions with concave cumulative distribution functions.

spread of the a_t distribution will reduce the expected growth rate

$$g = E_a[\ln T_{t+1} - \ln T_t], \tag{2}$$

under the reasonable assumption that $z\pi\left(w - z\right)$ is increasing around the equilibrium value z_c (which is true for λ sufficiently small so that z_c is also small). Indeed, for given z, the ex post growth rate is reduced in the low state $\underline{a}$ while it is not affected in the high state. In addition, such a mean preserving spread of the a_t distribution will discourage constrained firms to engage in long-term innovative investment z since such an investment is less likely to be successful in the low-state of the world, whereas this mean preserving spread will not affect long-term investment by unconstrained firms. This, in turn, further reduces the expected growth rate g.

A higher fraction of credit constrained firms, i.e. a lower μ, will also reduce expected growth since constrained firms invest less in long-term projects. Finally, a mean-preserving spread of the a_t distribution will reduce the expected growth rate g more the higher the fraction of credit constrained firms in the sector as it affects only these firms. Hence long-term investments and therefore the expected growth rate are more negatively affected by aggregate volatility when the number of unconstrained firms μ is lower. Denoting by σ the variance of the aggregate shock, one then gets:[13]

$$\frac{\partial g}{\partial \mu} > 0,\ \frac{\partial g}{\partial \sigma} < 0 \text{ and } \frac{\partial^2 g}{\partial \sigma \partial \mu} > 0. \tag{3}$$

Overall, under realistic assumptions on the profit function, a countercyclical fiscal policy aimed at reducing aggregate volatility should have a more growth-enhancing effect in sectors with a larger fraction of credit constrained firms, thus typically in sectors which depend more on external finance or where asset tangibility is lower on average. Moreover, this effect

[13]See the Supplementary Material available online for details.

should be mainly driven by the fact that credit-constrained firms react more to increased aggregate volatility in downturns than in upturns.[14] These are the main predictions which are being tested in the remaining part of the paper.

3. Econometric methodology and data

Can differences in fiscal policy cyclicality across countries and in financial constraints across industries account for cross-country, cross-industry growth differences? To answer this question, we use the methodology proposed in Rajan and Zingales (1998). There, the dependent variable is the average annual growth rate of real value added or labor productivity in industry i in country c for a given period of time, say $[t; t+n]$.[15,16] The original specification includes, as the main explanatory variable, the interaction between industry i's degree of financial constraints (fc_i) which will be measured with external financial dependence or asset tangibility (see below), and the degree of financial development (fd_c) in country c over the period $[t; t+n]$. Moreover a full set of industry and country dummies $\{\alpha_i; \beta_c\}$ – to control for unobserved heterogeneity across industries and across countries – as well as a control variable for initial conditions $\log \mathrm{y}_{i,c}^t$ are included on the right-hand side (henceforth, RHS).[17]

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[14] The same prediction also obtains in a variant of the model where the investment decision is taken *after* the aggregate productivity shock is realized. In that case one can show that $\frac{\partial g}{\partial \mu} > 0$ and $\frac{\partial^2 g}{\partial \sigma \partial \mu} > 0$ still hold and that $\frac{\partial g}{\partial \sigma} < 0$ provided that $\pi'^2 / (-\pi'')$ is increasing. This latter condition is satisfied for example when $\pi(k) = k^{\alpha}$ with $\alpha \in (0,1)$. If it does not hold, a mean-preserving spread of a_t increases the number of surviving projects for unconstrained firms only, so that the overall impact on the growth rate depends on the share of unconstrained firms.

[15] Labor productivity is defined as the ratio of real value added to employment. While we also have access to industry level data on hours worked, we choose to focus on productivity per worker rather than on productivity per hour as measurement error is more likely to affect the latter than the former.

[16] Note that this paper is the first to investigate the determinants of labor productivity growth using industry-level data. Neither Rajan and Zingales (1998) nor subsequent papers have looked at productivity growth. Rather, they limited their focus to value added growth. A second novelty of this paper is that labor productivity is computed using value added in volume terms while all previous studies use value added in value terms, on the basis that price deflators are similar for industries of a same country. Our dataset includes price deflators that are both country- and industry-specific.

[17] The variable $\mathrm{y}_{i,c}^t$ is the beginning of period ratio of labor productivity (resp. value added) in industry i in country c to total manufacturing labor productivity (resp. total manufacturing real value added) in country c when the dependent variable is the average annual growth rate of labor productivity (resp. real value added).

We extend this framework by adding on the RHS our variable of interest $(\mathrm{fc}_i) \times (\mathrm{fp}_c)$, namely the interaction between industry i's degree of financial constraint (fc_i) and the degree of fiscal policy (counter-) cyclicality (fp_c) in country c over the period $[t, t+n]$. Denoting $\varepsilon_{i,c}$ the error term, our main estimation equation – also referred to as the second stage regression – can then be expressed as:

$$\mathrm{g}_{i,c} = \alpha_i + \beta_c + \gamma\,(\mathrm{fc}_i) \times (\mathrm{fd}_c) + \delta\,(\mathrm{fc}_i) \times (\mathrm{fp}_c) - \mu \log \mathrm{y}^t_{i,c} + \varepsilon_{i,c} \tag{4}$$

Following Rajan and Zingales (1998) industry financial constraints are measured using firm-level data for the US. External financial dependence is measured as the median across all firms in a given industry of the ratio of total capital expenditures minus current cash flow to total capital expenditures. Asset tangibility is measured as the median across all firms in a given industry of the ratio of the value of net property, plant and equipment to total assets. These two variables are computed with data for the period 1980–1989. This methodology is predicated on the assumptions that: (i) differences in financial dependence/asset tangibility across industries are largely driven by differences in technology; (ii) technological differences persist over time across countries; (iii) countries are relatively similar in terms of the overall institutional environment faced by firms. Under those three assumptions, the US-based industry-specific measure is likely to be a valid interactor for industries in countries other than the US.[18] Now, there are good reasons to believe that these assumptions are satisfied particularly if the empirical analysis is restricted to a sample of OECD countries. For example, if pharmaceuticals require proportionally more external finance than textiles in the US, this is likely to be the case in other OECD countries.[19] Moreover, since little convergence

[18] Note however that this measure is unlikely to be useful for looking at the effect of policy on US growth as it likely reflects the equilibrium of supply and demand for capital in the US and therefore is endogenous to the growth process in the US economy.

[19] It should be stressed that the ordering of industries w.r.t. financial dependence or asset tangibility is assumed to be similar across different countries, not the specific values for financial dependence or asset tangibility of a given sector in different countries.

has occurred among OECD countries over the past 20 years, cross-country differences are likely to persist over time. Finally, to the extent that the US is more financially developed than other countries worldwide, US-based measures of financial dependence as well as asset tangibility are likely to provide the least noisy measures of industry level financial dependence or asset tangibility.

Let us now focus attention on how to measure financial development and fiscal policy cyclicality over the time interval $[t, t+n]$. Financial development (fd_c) can be assessed relatively easily using standard measures developed in the literature such as the ratio of private credit to GDP in each country. As an alternative, one can also use the ratio of financial system deposits to GDP in each country. Fiscal policy cyclicality (fp_c) is more difficult to determine because it cannot be observed as there is no direct measure for it. One hence needs an "auxiliary" equation – which is also referred to as the first stage regression – to infer fiscal policy cyclicality for each country of the sample. Our approach is to estimate fiscal policy cyclicality as the change in fiscal policy stemming from a given change in the domestic output gap. Thus we use country-level data over the period $[t; t+n]$ to estimate the following country-by-country "auxiliary" equation:

$$\mathrm{fb}_{c,\tau} = \eta_c + \mathrm{fp}_c \mathrm{z}_{c,\tau} + u_{c,\tau}, \tag{5}$$

where: (i) $\tau \in [t; t+n]$; (ii) $\mathrm{fb}_{c,\tau}$ is a measure of fiscal policy in country c in year τ: for example total fiscal balance to potential GDP; (iii) $\mathrm{z}_{c,\tau}$ measures the output gap in country c in year τ, that is the percentage difference between actual and potential GDP, and therefore represents the country's current position in the cycle; (iv) η_c is a constant and $u_{c,\tau}$ is an error term. Equation (5) is estimated separately for each country c in our sample. For example, if the ratio of fiscal balance to potential GDP is on the left-hand side (henceforth, LHS) of (5), a positive (resp. negative) regression coefficient (fp_c) reflects a countercyclical (resp. pro-cyclical) fiscal policy as the country's fiscal balance improves (resp. deteriorates) in upturns (resp. in downturns). Note that it is helpful to consider fiscal policy indicators in regression (5) as ratios to potential and not current GDP to make sure that the cyclicality parameter (fp_c) captures changes in the numerator – related to fiscal policy – rather than changes in the denominator – related to cyclical variations in output –.[20,21]

Following Rajan and Zingales (1998), we rely on a simple OLS procedure to estimate our second stage regression (4), correcting for heteroskedasticity bias whenever needed, without worrying much further about endogeneity issues. In particular, both interaction terms between industry-specific characteristics and fiscal policy cyclicality on the one hand and between industry specific characteristics and financial development on the other hand are likely to be largely exogenous to the LHS variable, be it industry labor productivity or value added growth. First, industry-specific characteristics pertain to industries in the US while the growth variable on the LHS involves countries other than the US. Hence reverse causality whereby industry growth outside the US could affect external financial dependence or asset tangibility of industries in the US, seems quite implausible. Second, financial development and fiscal policy cyclicality are measured at a macro level whereas the LHS variable is measured at industry level, which again reduces the scope for reverse causality as long as each individual industry represents a small fraction of the economy's total output. Yet, as an additional test that the results are not driven by endogeneity considerations, we provide IV regressions where we instrument for fiscal policy cyclicality.[22]

[20] When data are available, we also measure fiscal policy using cyclically adjusted variables. In this case, the cyclicality of fiscal policy results more directly from discretionary policy. Put differently, cyclicality stemming from automatic stabilizers is purged out. Unreported results – available upon request – are very similar to the case where fiscal policy indicators are not cyclically adjusted.

[21] More elaborate fiscal policy specifications can also be considered. In particular, following Galí et al (2003), a debt stabilization motive as well as a control for fiscal policy persistence can be included on the RHS of equation (5). Letting $\mathrm{b}_{c,\tau}$ denote the ratio of public debt to potential GDP in country c in year τ, fiscal policy cyclicality $\left(\mathrm{fp}_{2,c}\right)$ over the period $[t; t+n]$ can be estimated using a modified "auxiliary" equation as follows: $\mathrm{fb}_{c,\tau} = \eta_c + \theta_c \mathrm{fb}_{c,\tau-1} + \mathrm{fp}_{2,c} \mathrm{z}_{c,\tau} + \lambda_c \mathrm{b}_{c,\tau-1} + v_{c,\tau}$ where $\mathbf{z}_{c,\tau}$ is the output gap in country c in year τ, $\mathrm{fb}_{c,\tau-1}$ is the fiscal policy indicator in country c in year $\tau-1$ and $v_{c,\tau}$ is an error term. Unreported results – available upon request – provide results that are very similar both quantitatively and qualitatively to the case where fiscal policy cyclicality is inferred using the simple specification (5).

[22] Results from IV regressions show a large degree of similarity with those of OLS estimations, thereby confirming that our basic empirical strategy properly addresses the endogeneity issue.

Our data sample focuses on 15 industrialized OECD countries plus the US.[23] Data for this country sample are available for the period 1980–2005.[24] Industry-level real value added and labor productivity data are drawn from the EU KLEMS dataset (O'Mahony and Timmer, 2009). We focus on manufacturing industries disaggregated at the two and three digit levels according to the International Standard Industrial Classification revision 3.1 (ISIC 3.1). The primary source of data for measuring industry financial dependence and asset tangibility is Compustat, which compiles balance sheets and income statements for US-listed firms. More specifically, the industry-level indicators are computed as in Raddatz (2006) for financial dependence and as in and the industry-level indicators Braun and Larrain (2005) for asset tangibility. Fiscal and other macroeconomic variables are drawn from the OECD Economic Outlook database and from the World Bank Financial Development and Structure database (Beck et al, 2000).

4. Results

This section describes our empirical results. The first stage regressions deliver estimates for fiscal policy cyclicality, then the second stage regressions show how countercyclical fiscal policy affect growth more positively in sectors with higher financial dependence or lower asset tangibility. Robustness checks are performed at the end of the section.

4.1. Fiscal policy cyclicality estimates and industry financial constraints

The upper panel histogram in Figure 2 show the country by country estimates as well as the estimated confidence interval at the 10% level for fiscal policy cyclicality when the dependent variable in equation (5) is the primary fiscal balance to potential GDP.[25] The

[23] List of countries in the sample: Australia, Austria, Belgium, Denmark, Spain, Finland, France, Great Britain, Greece, Ireland, Italy, Japan, Netherlands, Portugal and Sweden.

[24] We present here the empirical results related to the 1980–2005 period. Estimations on sub-samples with shorter time span are available upon request.

[25] The confidence interval at the 10% level is $[m - 1.645\sigma; m + 1.645\sigma]$ where m and σ respectively denote the coefficient (fp_c) and standard error for the coefficient (fp_c) in equation (5) estimation.

primary fiscal balance corresponds to the total fiscal balance from which interest payments to or from the government are excluded. According to these estimates, the most countercyclical countries in our sample are Sweden and Denmark. In these two countries, primary fiscal balance to potential GDP increases by nearly 1.7 percentage points in response to a 1 percentage point increase in the domestic output gap. The Swedish and Danish governments are therefore more likely to run a surplus when their respective economy experiences a boom (i.e. a positive output gap) and more likely to run a deficit when their respective economy experiences a bust (i.e. a negative output gap). Conversely, the least countercyclical countries – or, put differently, the most procyclical countries – in our sample are Greece and Italy. In these two countries, the sensitivity of the ratio of primary fiscal balance to potential GDP to the domestic output gap is negative: the government runs a larger surplus or a lower deficit, when the output gap decreases, i.e. when the economy deteriorates.

Second, one can provide a snapshot of industry measures of financial constraints. The lower panel histogram in Figure 2 indeed provides a subsample of the measures for financial dependence and asset tangibility. Office, accounting and computing machinery (office in Figure 2, lower panel) on the one hand and radio, television and communication equipment and apparatus (radio in Figure 2, lower panel) on the other hand display the highest dependence on external finance.

In these two sectors the median firm finances more than 70% of its capital expenditures through external funds. On the contrary, food products and beverages (food in Figure 2, lower panel) and tobacco products (tobacco in Figure 2, lower panel) display the lowest dependence on external finance. In these two sectors, financial dependence is negative, meaning that the median firm earns cash flows that exceed capital expenditure. Turning to asset tangibility, this is largest for coke, refined petroleum products and nuclear fuel (coke in Figure 2, lower panel) and paper and paper products (paper in Figure 2, lower panel). More than 40% of assets are tangible assets in these two industries. By contrast, office, accounting and computing machinery (office in Figure 2, lower panel) and medical, precision and optical instruments, watches and clocks (medical instruments in Figure 2, lower panel) display the lowest tangibility, with tangible assets accounting for no more than 20% of total assets.

Last, let us investigate bivariate correlations between fiscal policy cyclicality and some macroeconomic variables. According to the upper left and middle panel in Figure 3, fiscal policy countercyclicality – measured through the output gap sensitivity of total fiscal balance to potential GDP – is positively correlated with the average total fiscal balance to GDP and the average fiscal expenditures to GDP ratios. This suggests that countries with a more countercyclical fiscal policy are countries with higher levels of fiscal discipline and/or countries with a larger government. Next, the upper right and lower left panels in Figure 3 show that fiscal policy countercyclicality correlates positively with average productivity growth but negatively with the volatility of productivity growth. This means that countries with a more countercyclical fiscal policy have on average experienced faster growth and lower volatility, consistent with the view that countercyclical fiscal policy should help stabilize the economy and thereby help it grow faster. Finally, the lower middle and lower right panels in Figure 3 show no systematic correlation between fiscal policy countercyclicality and financial development, the latter being measured by average private credit to GDP or average financial system deposits to GDP.

4.2. The second stage estimation

One can now estimate our main regression equation (4), with real value added growth as the LHS variable, using financial dependence or asset tangibility as industry-specific interactors (table 1). Financial development is measured using either private credit to GDP or financial system deposits to GDP. Fiscal policy cyclicality is estimated using alternatively the ratio of total or primary fiscal balance to potential GDP – as the LHS variable in regression

(5).[26]

First, real value added growth is significantly and positively (resp. negatively) correlated with the interaction of external financial dependence (resp. asset tangibility) and fiscal policy countercyclicality. A larger sensitivity to the output gap of total fiscal balance to potential GDP raises industry real valued added growth the more so for industries with higher financial dependence or lower asset tangibility. This result is robust to using primary instead of total fiscal balance: industries with larger financial dependence or lower asset tangibility tend to benefit more from a more countercyclical fiscal policy in the sense of a larger sensitivity of the primary fiscal balance to variations in the output gap. Estimated coefficients are however smaller in absolute value when fiscal policy countercyclicality is estimated using the primary fiscal balance. This is related to the fact that the cross-country dispersion in the cyclicality of the primary fiscal balance is larger than the cross-country dispersion in the cyclicality of total fiscal balance. Second, real value added growth is significantly correlated with the interaction of external financial dependence (or asset tangibility) and financial development but only when the latter is measured using financial system deposits to GDP. Industries with higher external financial dependence or lower asset tangibility effectively benefit more from higher financial development as indicated by a larger ratio of financial system deposits to GDP. But the result does not hold for private credit to GDP as the correlation between industry real value added growth and the interaction of private credit to GDP and financial dependence or asset tangibility is never significant at standard confidence levels.

Three remarks are worth making at this point. First, the estimated coefficients for the interaction of fiscal policy countercyclicality and financial dependence or asset tangibility are highly significant – in spite of the relatively conservative standard errors estimates which are clustered at the country level. Second, the pairwise correlation between industry financial dependence and industry asset tangibility is around -0.6 which is significantly below -1. In other

[26] Unreported results using fiscal policy indicators as ratios of current and not potential GDP are very similar and available upon request from the authors.

words, these two variables are far from being perfectly negatively correlated, which in turn implies that the regressions with financial dependence as the industry-specific characteristic are not just mirroring regressions where asset tangibility is the industry-specific characteristic. Instead these two set of regressions convey complementary information. Finally, the estimated coefficients for the interaction term between industry financial constraints and fiscal policy countercyclically remain essentially the same – both in statistical significance and economic magnitude – whether the proxy for financial development is private credit to GDP or financial system deposits to GDP.

One can repeat the same estimation exercise (Table 2), but taking labor productivity as the LHS variable in our main estimation equation (4). Comparing the results from this new set of regressions with the previous one will in turn allow us to decompose the overall effect of fiscal policy countercyclicality on industry value added growth into employment growth and productivity growth. As is shown in Table 2, labor productivity growth is significantly affected by the interaction between financial dependence/asset tangibility and fiscal policy cyclicality: a larger sensitivity to the output gap of total or primary fiscal balance to potential GDP raises industry labor productivity growth to a greater degree for industries with higher financial dependence or lower asset tangibility. But the interaction of financial dependence/asset tangibility and financial development is never found to be significant in accounting for industry labor productivity growth. In other words, the effect of financial development is limited to raising real value added growth without any effect on labor productivity growth. On the contrary, fiscal policy cyclicality does affect industry real value added growth and part of this effect comes from its impact on labor productivity growth.

4.3. Magnitude of the effects

How large are the effects implied by the above regressions? To get a sense of the magnitudes involved, we compute the difference in labor productivity growth gains for an industry whose external financial dependence would increase from the 25$^{\text{th}}$ percentile to the 75$^{\text{th}}$ percentile of the financial dependence distribution when the country would increase the countercyclicality of its fiscal policy from the 25$^{\text{th}}$ to the 75$^{\text{th}}$ percentile. Then, the same exercise is repeated, but replacing financial dependence by asset tangibility (which moves from the 75$^{\text{th}}$ to the 25$^{\text{th}}$ percentile of the corresponding distribution).[27] As is shown at the bottom of Table 2, the gain in productivity growth lies between 1.1 and 2.2 percentage points per year. These magnitudes are fairly large especially when compared to the corresponding figures in Rajan and Zingales (1998). According to their results, the difference from moving from the 25$^{\text{th}}$ to the 75$^{\text{th}}$ percentile in the level of financial dependence and financial development simultaneously, is roughly equal to 1 percentage point per year.

However, the following considerations are worth pointing out. First, these are difference-in-difference (cross-country/cross industry) effects, which are not interpretable as country-wide effects.[28] Second, we are looking only at manufacturing sectors, which represent less than 40% of total GDP of countries in our sample. Third, given the relatively small set of countries in our sample, there is a fairly large degree of dispersion in fiscal policy cyclicality across countries in our sample. Hence moving from the 25$^{\text{th}}$ to the 75$^{\text{th}}$ percentile in the countercyclicality of total or primary fiscal balance to potential GDP corresponds to a dramatic change in the design of fiscal policy over the cycle, which in turn is unlikely to take place in any individual country over a short period of time. Fourth, this simple computation

[27] The presence of industry and country fixed effects prevents us from evaluating the impact of a change in fiscal policy cyclical pattern for a given industry or conversely from evaluating the effect of a change in industry characteristics (financial dependence or asset tangibility) in a country with a given cyclical pattern of fiscal policy.

[28] It could be that a more countercyclical fiscal policy simply redistributes growth across sectors without any impact at the macro level, because the gains for some industries – here the most financially dependent ones – would be compensated by the loss for some others – here the least financially dependent industries.

does not take into account the possible costs associated with the transition from a steady state with low fiscal countercyclicality to a steady state with high fiscal countercyclicality. Yet, the above exercise suggests that differences in the cyclicality of fiscal policy are an important driver of the observed cross-country/cross-industry differences in value added and productivity growth.[29]

5. Robustness checks

According to the above results, only fiscal policy cyclicality seems to have a significant effect on industry labor productivity growth when interacted with industry financial constraints. Hence, because our focus is primarily on productivity growth, we shall restrict our empirical specification, consistent with the previous results and base our further investigations on the following specification:

$$\mathrm{g}_{i,c} = \alpha_i + \beta_c + \delta\left(\mathrm{fc}_i\right) \times \left(\mathrm{fp}_c\right) - \mu \log \mathrm{y}_{i,c}^{t} + \varepsilon_{i,c}. \tag{6}$$

Based on this equation, we investigate the robustness of the effect of countercyclical fiscal policy on industry growth. In particular, to what extent are our results driven by the existence of omitted variables, by sample selection or by the choice of econometric methodology?

5.1. Competing stories and omitted variables: Financial development.

Is it possible that other factors or stories explain the correlation between industry growth and the cyclicality of fiscal policy? We now study a few alternative explanations. As noted above, the empirical methodology used in this paper was originally developed to test the effect of financial development on growth. Yet, the evidence provided so far shows that financial development when interacted with industry financial constraints does not seem to have much

[29] Yet another limit relates to the relatively small number of countries in our sample. Because we focus exclusively on developed countries and abstract from emerging and developing countries, the sample on which we estimate the distribution quantiles for fiscal policy countercyclicality is relatively small.

of a significant effect on labor productivity growth. To test this hypothesis more deeply, we consider three other alternative proxies for financial development. In columns (i) to (iii) in Tables 3 and 4, financial development is measured respectively by the ratio of bank credit to GDP, the ratio of domestic bank assets to GDP, and the real long-term interest rate. The first of these measures is the restriction of private credit to its banking component, the second gives a measure of the stock of bank assets as opposed to the flow of credit, and the third measure gives an indication of the prevalent cost of capital in the economy. The empirical results show that none of these proxies when interacted with financial dependence (Table 3) or asset tangibility (Table 4) has a significant effect on labor productivity growth, which confirms the result obtained in the previous estimations. Moreover, neither the significance nor the magnitude of the interaction term between financial dependence/asset tangibility and the cyclicality of fiscal policy is affected by controlling for these various measures of financial development and their interactions with industry-level measures of financial constraints. In other words, the effect of fiscal policy cyclicality on industry growth remains unchanged both qualitatively and quantitatively once financial development is controlled for these three different proxies. Yet, this does not mean that financial development does not matter. However, our results suggest that, if it matters, it is primarily through its effects on fiscal policy countercyclicality.

5.2. Competing stories and omitted variables: Inflation.

Inflation may also affect productivity growth, particularly in more financially dependent sectors. In particular, inflation is widely perceived as having a negative impact on the allocative efficiency of capital across sectors, the idea being that higher inflation makes it more difficult for investors to identify high-productivity projects. In this case, the higher the inflation rate, the less efficiently should the financial system allocate capital across sectors. And, to the extent that those sectors that suffer more from capital misallocation are the more financially dependent sectors, inflation is more likely to have a negative effect on productivity growth for industries with heavier reliance on external finance. In contrast, in industries with little or no financial dependence, this negative effect of inflation is less likely to hold.[30] Column (iv) in Table 3 indeed shows that the interaction of inflation and financial dependence is never a significant determinant of labor productivity growth at industry level. The same applies to the interaction between inflation and industry asset tangibility (see column (iv) in Table 4). Finally, we investigate whether this absence of any significant effect of inflation could be related to the level of central bank policy rates, given that central banks tend to determine their policy rates according to inflation figures (see column (v) in Tables 3 and 4). However, even after central bank policy rates are controlled for, the interaction between fiscal policy cyclicality and industry financial dependence/asset tangibility remains significant. This suggests that the positive growth effect of stabilizing fiscal policies in more financially constrained industries is largely unrelated to average inflation in a country: for a given inflation rate, strengthening the countercyclical pattern of fiscal policy raises growth more in industries with higher financial dependence or with lower asset tangibility. As previously seen, however, these results do not imply that high inflation is not costly as it is likely to affect the government's ability to carry out a stabilizing fiscal policy.

5.3. Competing stories and omitted variables: Fiscal discipline and size of government.

If the cyclical component of fiscal policy does significantly affect industry value added growth or labor productivity growth, it is likely that the permanent component of fiscal policy could play a similar role. In fact, it could be the case that countercyclical fiscal policy is positively correlated with industry growth not so much because countercyclicality per se is growth-enhancing but rather because a more countercyclical fiscal policy reflects a more

[30] A reinforcing consideration is that increases in short-term interest rates by central banks in response to higher inflation or higher than expected inflation should also have a negative effect on industry value added and productivity growth – and this effect should be larger for industries with higher financial dependence or lower asset tangibility.

stringent degree of fiscal discipline over the cycle. In the same vein, the cyclicality of fiscal policy might be a proxy for the relative size of government. To address this potential objection, we consider four controls for different fiscal institutional characteristics: average fiscal balance, average government expenditures, average government revenues and average gross government debt. The first measure captures fiscal discipline, the second and third measures capture the relative size of government, while the fourth measure represents both the relative size of the government as well as the debt burden that can hinder fiscal policy countercyclicality. Columns (vi)–(ix) in Tables 3 and 4 show that in the horse race between the cyclicality of fiscal policy and these four measures of structural fiscal policy, countercyclicality in the primary fiscal balance is a significant determinant of industry growth irrespective of the control variable considered. Moreover, none of these controls shows a significant effect in the interaction with financial dependence or asset tangibility. This does not imply that fiscal discipline, for example as reflected through a moderate average fiscal deficit, does not matter for industry growth: tighter fiscal discipline should actually make it easier for a government to implement a more countercyclical fiscal policy whereas large average fiscal deficits should make it harder for any government to stabilize the economy in downturns, particularly if the government faces a borrowing constraint.

5.4. Dealing with the variability in fiscal cyclicality estimates.

An important limitation to the empirical analysis carried out so far is that fiscal policy countercyclicality cannot be directly observed: instead, it can only be inferred through an auxiliary regression. This raises a number of issues, among them the fact that countercyclicality is measured with a standard error. Hence our estimates can provide only a "noisy" signal of fiscal policy countercyclicality for each country. This problem can be dealt in two possible ways.[31]

[31] In other words, the analysis exposed in this subsection is meant to rule out the possibility that our above findings might simply reflect that the standard error around the estimates of fiscal policy counter-cyclicality

A first approach is to reproduce the uncertainty surrounding our fiscal policy estimates and to check whether it affects the results of our second stage regression. More precisely, we adopt the following three-step procedure. First, instead of considering the average coefficient fp_c estimated in the first stage regression as an explanatory variable in our second stage regression, we draw for each country c a fiscal policy cyclicality index fpi_c from a normal distribution with mean fp_c and standard deviation σ_{fp_c}, where σ_{fp_c} is the standard error for the coefficient fp_c estimated in the first stage regression. Typically the larger the estimated standard deviation σ_{fp_c}, the more likely the fiscal policy cyclicality index fpi_c for country c will be different from the average coefficient fp_c. Secondly we run the second stage regression using the randomly drawn fiscal policy cyclicality indexes fpi_c:

$$\mathrm{g}_{i,c} = \alpha_i + \beta_c + \delta\,(\mathrm{fc}_i) \times (\mathrm{fpi}_c) - \mu \log \mathrm{y}^t_{i,c} + \varepsilon_{i,c} \tag{7}$$

Running this regression yields an estimated coefficient δ and an estimated standard deviation σ_δ. We repeat this same procedure 2000 times, and thereby obtain a series of (2000) estimated coefficients δ and standard errors σ_δ. As a last step, we average across all draws to obtain an average $\overline{\delta}$ of estimated coefficients and $\overline{\sigma_\delta}$ of estimated standard errors. The statistical significance can eventually be tested on the basis of the averages $\overline{\delta}$ and $\overline{\sigma_\delta}$. The results of this estimation procedure are shown in Table 5. The interaction of fiscal policy cyclicality and industry financial constraints (either financial dependence or asset tangibility) still has a significant effect on industry growth. The estimated parameter is slightly smaller than its counterpart in the simple OLS regression in Table 2. However the difference is by no means statistically significant. Hence neither the significance nor the magnitude of our main effect appear to be related to a possible bias stemming from the use of a generated regressor. In other words, the simple OLS regression does not seem to provide significantly biased results.

has not been properly taken into account.

5.5. Instrumental variable estimation

A second approach to dealing with the uncertainty surrounding our fiscal policy estimates is to perform instrumental variable estimations, considering the second stage regression as a model with errors-in-variables in which we observe only a noisy signal of the explanatory variable(s). Here we instrument fiscal policy countercyclicality using a set of instrumental variables that share two basic characteristics. First, these variables are directly observed; none is inferred from another model or regression. Second, these variables are all predetermined: that is, the period over which the instrumental variables are observed is prior to the time interval over which the auxiliary regressions that determine our countercyclicality measure are being run. More specifically, we perform two alternative sets of IV estimations. In the first set, the instruments are "economic" variables, for example, GDP per worker, the ratio of imports to GDP, CPI inflation, nominal long-term interest rate, nominal short-term interest rate, private credit to GDP, financial system deposits to GDP. In the second set of IV estimations, the instruments are legal and political variables: legal origin (English, French, German, Scandinavian), district magnitude and an index for government centralization (ratio of central to general government expenditures).[32]

Results are provided in Table 6 where estimations in columns (i)–(iv) use "economic" instruments and estimations in columns (v)–(viii) use "legal and political" instruments. Three main results emerge from this exercise. First, no matter which underlying fiscal policy indicator we consider, and no matter which type of instruments we use (economic or legal and political) a more countercyclical fiscal policy has an increasingly significant positive effect on industry growth as the degree of industry external financial dependence rises or as industry asset tangibility falls in the IV regressions. Second, the effects implied by the IV estimations are of comparable magnitude to those implied by the above OLS regressions: the interaction coefficients are at least as large and often larger (in absolute value) in the IV

[32] Data on countries legal origin are drawn from La Porta et al (1998) while other legal and political variables are drawn from Persson and Tabellini (1999, 2002).

estimations than in the OLS estimations.[33] Finally, the Hansen test for instrument validity is always accepted at the 10% level.

5.6. Asymmetry between booms and slumps

Our theoretical argument relied on the assumption that credit constraints are more likely to bind in downturns. This implied that the interaction between firms' credit constraints and fiscal countercyclicality should become stronger during downturns. Table 7 tests this prediction by running the second stage regression separately for country-years where the output gap is respectively below its historical median for the corresponding country (columns (i)–(iv)) and above its historical median (columns (v)–(vi)) for the corresponding country. When credit constraints are (inversely) measured by asset tangibility of the corresponding sector in the US (columns (iii)–(iv) and (vii)–(viii)), the interaction coefficients are significant only when the output gap is below median. This confirms that countercyclical fiscal policy raises growth disproportionately for industries with low asset tangibility essentially by dampening the intensity of downturns. When credit constraints are measured by the external financial dependence of the corresponding sector in the US (columns (i)–(ii) and (v)–(vi)), then the interaction coefficients are larger when the output gap is below median. That they remain significant when the output gap is above median may reflect expectations-related effects: for example, with higher taxes in booms firms may anticipate higher subsidies or lower taxes in subsequent slumps, which in turn should have a more positive effect on their growth-enhancing investments, particularly for firms that are more credit-constrained.

[33] Note that R-squared are much lower for IV than for OLS regressions. The reason has to do with the country and industry dummies which are included in computing the R-squared in the OLS regressions but not in the IV regressions.

6. Conclusions

"Short-run" macroeconomic policy undertaken to smooth the business cycle can affect "long-run" industry growth. Following the Rajan and Zingales (1998) methodology, the paper has focused on the interaction between credit constraints at the industry level (measured either by external financial dependence or by the negative of asset tangibility in US industries) and the cyclicality of fiscal policy at the country level, and assessed the impact of this interaction on industry value added and productivity growth. Using this methodology, which helps address potential endogeneity issues, we have provided evidence that a more countercyclical fiscal policy enhances value added and productivity growth more in more financially constrained industries, i.e. in industries whose US counterparts are more dependent on external finance or display lower asset tangibility. This result appears to survive a number of robustness tests, in particular the inclusion of structural macroeconomic variables such as financial development, inflation and average fiscal deficits. This, in turn, suggests either that the growth impact of the cyclical pattern of fiscal policy is of comparable (or even greater) importance to that of more structural features, or that the effect of these structural features operates at least partly through their own effects on the cyclicality of fiscal policy.

The analysis in this paper suggests at least three avenues for future research. The first would be to investigate which component of fiscal policy drives the relationship between industry growth and the cyclicality of fiscal policy. A second question is whether the above analysis can be transposed to monetary policy. A positive answer to this question would be all the more important as monetary policy can presumably be more easily modified over time than fiscal policy, although transmission lags may be larger for monetary than for fiscal policy. Finally comes the question of the determinants of countercyclical fiscal policy, and especially the institutional features or arrangements that foster or prevent countercyclicality. Answering this question will shed new light on the ongoing debate about the relationship between institutions and growth.

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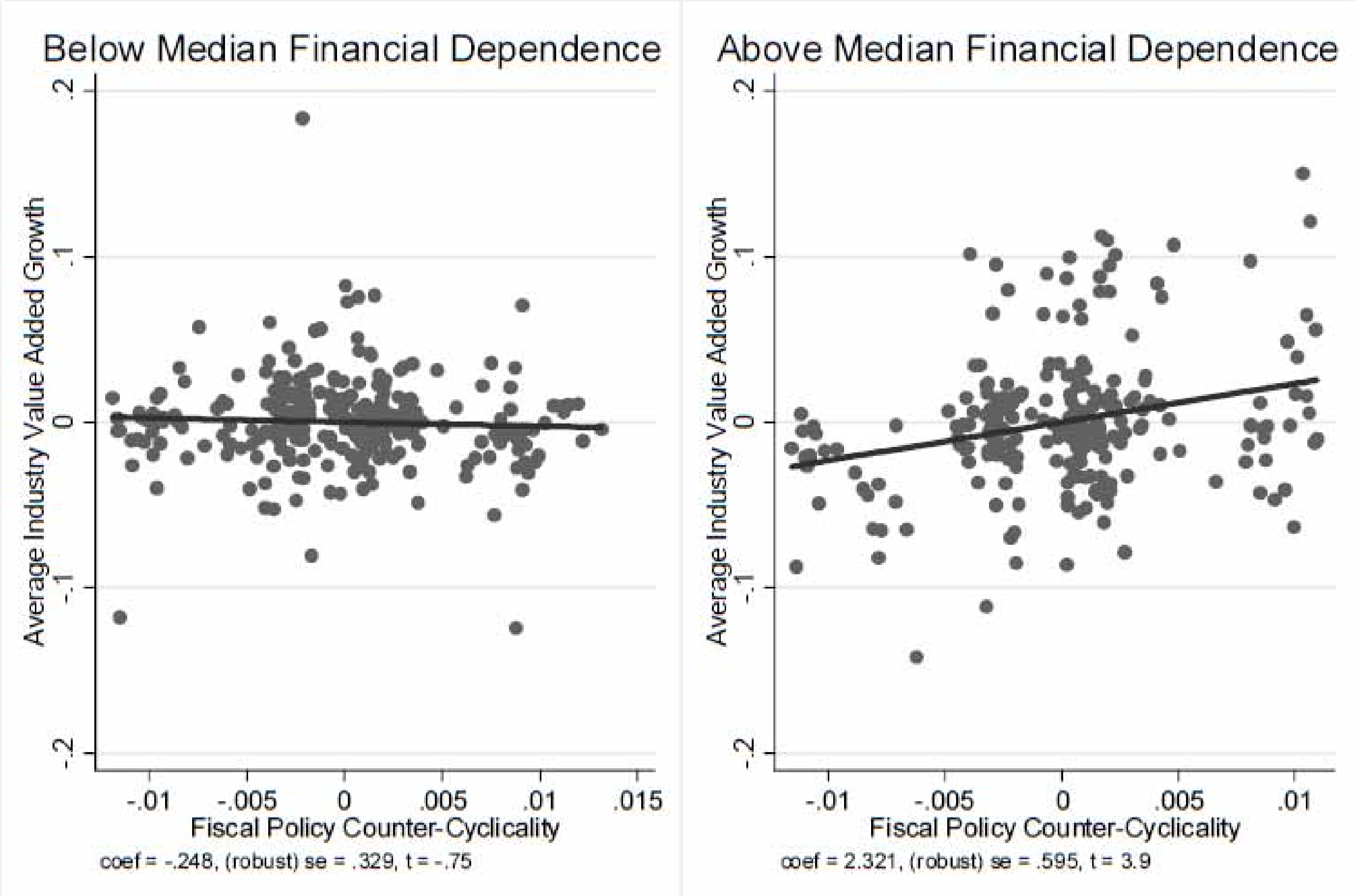
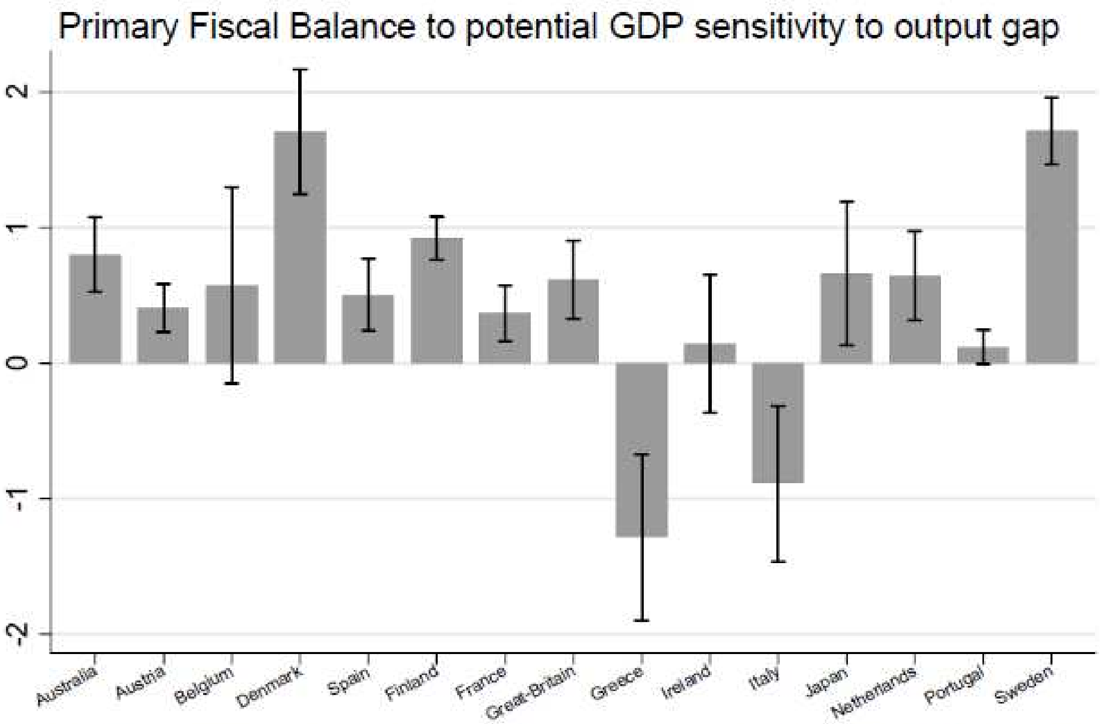
Figure 1: The effect of fiscal policy counter-cyclicality on industry real value added growth

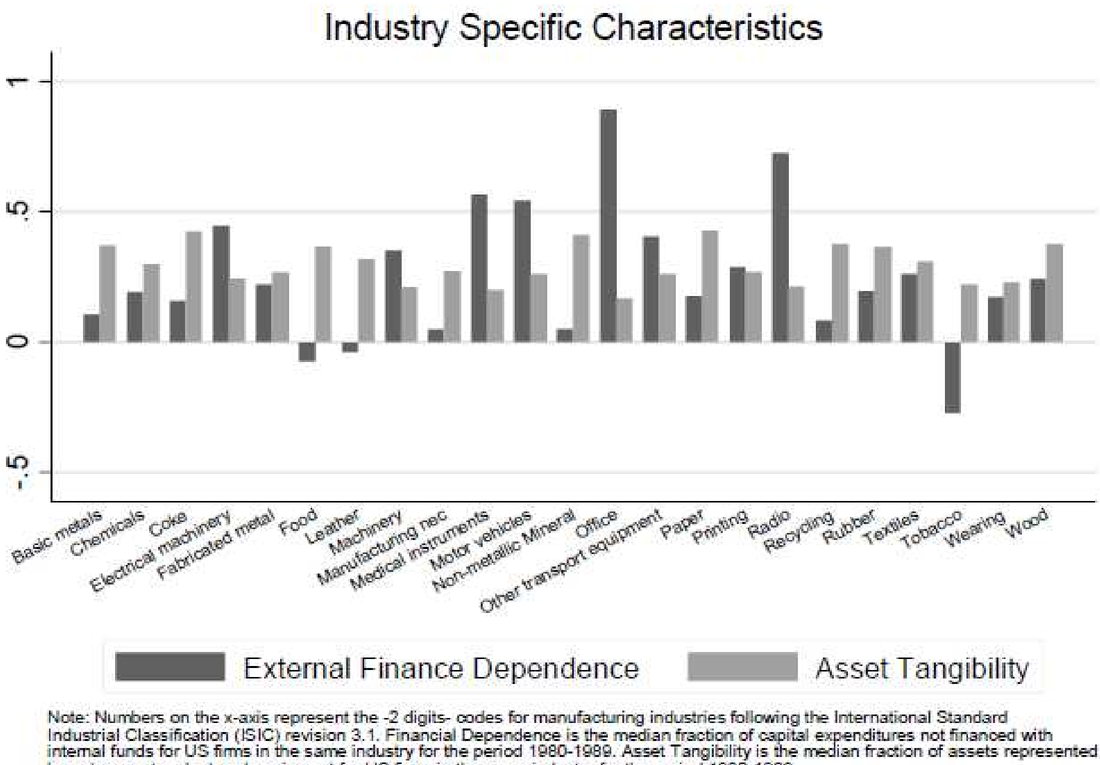


Note: The left (resp. right) hand panel is the scatter plot of real value added average growth for industries with below (resp. above) median financial dependence against the output gap sensitivity of total fiscal balance to potential GDP, controlling for the industry initial share in total manufacturing valued added and industry specific effects. Average growth and output gap sensitivity computed over 1980-2005.

Figure 2: Country and Industry specific characteristics

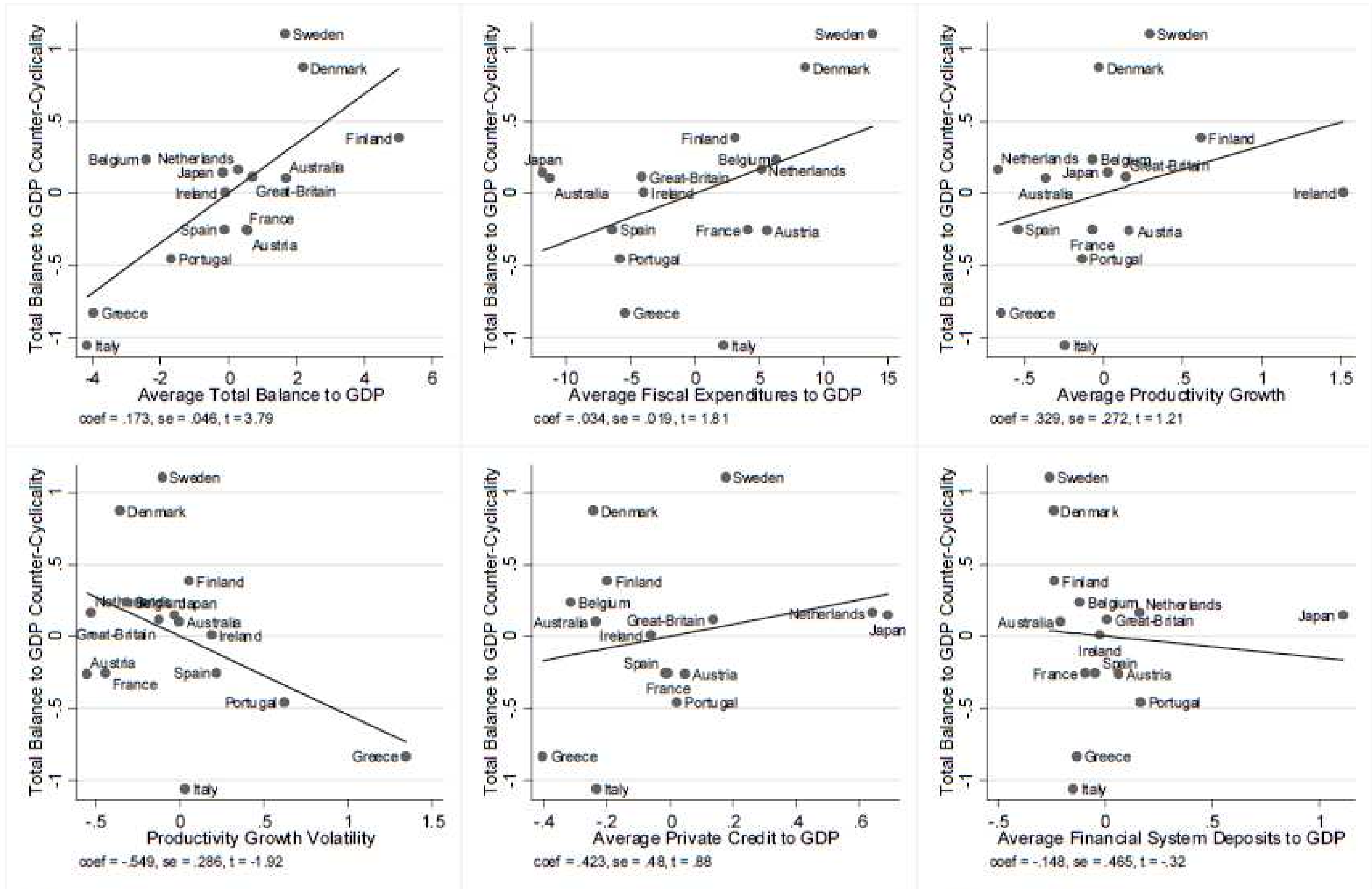


Note:Each bar represent the output gap sensitivity of primary fiscal balance to potential GDP for the period 1980-2005 for each country. The black line indicates the confidence interval at the 10% level around the sensitivity estimate for each country.



Note: Numbers on the x-axis represent the -2 digits- codes for manufacturing industries following the International Standard Industrial Classification (ISIC) revision 3.1. Financial Dependence is the median fraction of capital expenditures not financed with internal funds for US firms in the same industry for the period 1980-1989. Asset Tangibility is the median fraction of assets represented by net property, plant and equipment for US firms in the same industry for the period 1980-1989.

Figure 3: Bivariate Correlations



Note: Fiscal Policy Counter-Cyclicality is the output gap sensitivity of total fiscal balance to potential GDP. Average Total Fiscal Balance (resp. Fiscal Expenditures) to GDP is the mean of total fiscal balance (resp. fiscal expenditures) to GDP. Average Productivity Growth (resp. Productivity Growth Volatility) is the mean (resp. standard deviation) of productivity growth. Average Private Credit (resp. Financial System Deposits) to GDP is the mean of private credit (resp. financial system deposits) to GDP. All variables are computed over 1980-2005.

Table 1: Baseline Regressions

Dependent variable: Real Value Added Growth	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)
Log of Initial Share in Manufacturing Value Added	**-0.883****	**-0.866*****	**-0.855**	**-0.850**	**-0.551**	**-0.527**	**-0.547**	**-0.524**
	(0.250)	*(0.220)*	*(0.273)*	*(0.235)*	*(0.346*	*(0.35*	*(0.351*	*(0.351*
Interaction (Financial Dependence and Total Fiscal Balance to potential GDP Counter-Cyclicality)	**6.343*****		**6.895*****					
	(1.419)		*(1.313)*					
Interaction (Financial Dependence and Primary Fiscal Balance to potential GDP Counter-Cyclicality)		**4.405*****		**4.758*****				
		(0.860)		*(0.782)*				
Interaction (Asset Tangibility and Total Fiscal Balance to potential GDP Counter-Cyclicality)					**-12.49****		**-13.60*****	
					(4.385)		*(4.256)*	
Interaction (Asset Tangibility and Total Fiscal Balance to potential GDP Counter-Cyclicality)						**-8.479****		**-9.168*****
						(2.965)		*(2.838)*
Interaction (Financial Dependence and Average Private Credit to GDP)	**3.32**	**2.668**						
	(3.310)	*(3.004)*						
Interaction (Financial Dependence and Average Financial System Deposits to GDP)			**3.527*****	**3.164****				
			(1.008)	*(1.092)*				
Interaction (Asset Tangibility and Average Private Credit to GDP)					**-5.852**	**-4.839**		
					(6.748)	*(5.951)*		
Interaction (Asset Tangibility and Average Financial System Deposits to GDP)							**-6.958****	**-6.091****
							(2.513)	*(2.431)*
Observations	528	528	528	528	528	528	528	528
R-squared	0.583	0.581	0.584	0.582	0.561	0.56	0.562	0.561

Note: The dependent variable is the average annual growth rate in real value added for the period 1980-2005 for each industry in each country. Initial Share in Manufacturing Value Added is the ratio of industry real value added to total manufacturing real value added in 1980. Financial Dependence is the median fraction of capital expenditures not financed with internal funds for US firms in the same industry for the period 1980-1989. Asset Tangibility is the median fraction of assets represented by net property, plant and equipment for US firms in the same industry for the period 1980-1989. Total (resp. Primary) Fiscal Balance to potential GDP Counter-Cyclicality is the coefficient of the output gap when total (resp. primary) fiscal balance to potential GDP is regressed on a constant and the output gap for each country. Average Private Credit to GDP is the mean for each country over 1980-2005 of private credit to GDP. Average Financial System Deposits to GDP is the mean for each country over 1980-2005 of financial system deposits to GDP. The interaction variable is the product of variables in parentheses. Estimated coefficients are in percentage. Standard errors -clustered at the country level- are in parentheses. All estimations include country and industry dummies. Significance at the 1% (resp. 5%; 10%) level is indicated by *** (resp. **; *).

Table 2: Baseline Regressions

Dependent variable: Labor Productivity Growth	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)
Log of Initial Relative Labor Productivity	**-2.530***** *(0.530)*	**-2.533***** *(0.572)*	**-2.524***** *(0.530)*	**-2.524***** *(0.577)*	**-2.508***** *(0.503)*	**-2.503***** *(0.533)*	**-2.508***** *(0.501)*	**-2.501***** *(0.533)*
Interaction (Financial Dependence and Total Fiscal Balance to potential GDP Counter-Cyclicality)	**4.850***** *(0.749)*		**5.014***** *(0.742)*					
Interaction (Financial Dependence and Primary Fiscal Balance to potential GDP Counter-Cyclicality)		**3.370***** *(0.536)*		**3.426***** *(0.530)*				
Interaction (Asset Tangibility and Total Fiscal Balance to potential GDP Counter-Cyclicality)					**-12.31**** *(4.151)*		**-13.00***** *(4.13)*	
Interaction (Asset Tangibility and Primary Fiscal Balance to potential GDP Counter-Cyclicality)						**-7.834**** *(2.905)*		**-8.278***** *(2.735)*
Interaction (Financial Dependence and Average Private Credit to GDP)	**0.877** *(2.436)*	**0.337** *(2.483)*						
Interaction (Financial Dependence and Average Financial System Deposits to GDP)			**1.221** *(1.083)*	**0.949** *(1.360)*				
Interaction (Asset Tangibility and Average Private Credit to GDP)					**-3.971** *(4.246)*	**-3.356** *(4.317)*		
Interaction (Asset Tangibility and Average Financial System Deposits to GDP)							**-3.532** *(2.372)*	**-2.673** *(2.653)*
Differential in labor productivity growth (in percentage point)	**1.42**	**1.14**	**1.47**	**1.16**	**2.06**	**1.69**	**2.17**	**1.78**
Observations	523	523	523	523	523	523	523	523
R-squared	0.549	0.547	0.549	0.547	0.538	0.535	0.538	0.535

Note: The dependent variable is the average annual growth rate in labor productivity for the period 1980-2005 for each country in each industry. Initial Relative Labor Productivity is the ratio of industry labor productivity to total manufacturing labor productivity in 1980. Financial Dependence is the median fraction of capital expenditures not financed with internal funds for US firms in the same industry for the period 1980-1989. Asset Tangibility is the median fraction of assets represented by net property, plant and equipment for US firms in the same industry for the period 1980-1989. Total (resp. Primary) Fiscal Balance to potential GDP Counter-Cyclicality is the coefficient of the output gap when total (resp. primary) fiscal balance to potential GDP is regressed on a constant and the output gap for each country. Average Private Credit to GDP is the mean for each country over 1980-2005 of private credit to GDP. Average Financial System Deposits to GDP is the mean for each country over 1980-2005 of financial system deposits to GDP. The interaction variable is the product of variables in parentheses. Estimated coefficients are in percentage. Standard errors -clustered at the country level- are in parentheses. All estimations include country and industry dummies. Significance at the 1% (resp. 5%; 10%) level is indicated by *** (resp. **; *).

Table 3: Controlling for alternative effects

Dependent variable: Labor Productivity Growth	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)
Log of Initial Relative Labor Productivity	**-2.537***** *(0.574)*	**-2.539***** *(0.561)*	**-2.621***** *(0.654)*	**-2.549***** *(0.583)*	**-2.016***** *(0.610)*	**-2.543***** *(0.573)*	**-2.546***** *(0.569)*	**-2.554***** *(0.566)*	**-2.007*** *(0.910)*
Interaction (Financial Dependence and Primary Fiscal Balance to potential GDP Counter-Cyclicality)	**3.408***** *(0.501)*	**3.411***** *(0.470)*	**3.698***** *(0.716)*	**3.578***** *(0.851)*	**3.728***** *(0.606)*	**3.350***** *(0.597)*	**3.225***** *(0.766)*	**3.622***** *(0.546)*	**3.851***** *(0.727)*
Interaction (Financial Dependence and Average Private Credit by Banks to GDP)	**-0.002** *(2.536)*								
Interaction (Financial Dependence and Average Domestic Bank Assets to GDP)		**-0.415** *(2.113)*							
Interaction (Financial Dependence and Average Real long term interest rate)			**-0.427** *(0.836)*						
Interaction (Financial Dependence and Average CPI Inflation)				**0.078** *(0.315)*					
Interaction (Financial Dependence and Average Short term Nominal Policy interest rate)					**-0.03** *(0.327)*				
Interaction (Financial Dependence and Average Total Fiscal Expenditures to GDP)						**0.0147** *(0.095)*			
Interaction (Financial Dependence Average and Total Fiscal Revenues to GDP)							**0.029** *(0.094)*		
Interaction (Financial Dependence and Average Primary Fiscal Balance to GDP)								**-0.449** *(0.425)*	
Interaction (Financial Dependence and Average Gross Government Debt to GDP)									**-0.0236** *(0.032)*
Observations	523	523	490	523	482	523	523	523	347
R-squared	0.547	0.547	0.533	0.547	0.475	0.547	0.547	0.548	0.468

Note: The dependent variable is the average annual growth rate in labor productivity for the period 1980-2005 for each industry in each country. Initial Relative Labor Productivity is the ratio of industry labor productivity to total manufacturing labor productivity in 1980. Financial Dependence is the median fraction of capital expenditures not financed with internal funds for US firms in the same industry for the period 1980-1989. Primary Fiscal Balance to potential GDP Counter-Cyclicality is the regression coefficient of the output gap when primary fiscal balance to potential GDP is regressed on a constant and the output gap for each country. Averages of control variables are computed over the estimation period 1980-2005. Interaction variables are the product of variables in parentheses. Estimated coefficients are in percentage. Standard errors -clustered at the country level- are in parentheses. All estimations include country and industry dummies. Significance at the 1% (resp. 5%; 10%) level is indicated by *** (resp. **; *).

Table 4: Controlling for alternative effects

Dependent variable: Labor Productivity Growth	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)
Log of Initial Relative Labor Productivity	**-2.501*** **	**-2.501*** **	**-2.544*** **	**-2.501*** **	**-2.009*** **	**-2.500*** **	**-2.499*** **	**-2.491*** **	**-1.884* **
	(0.535)	*(0.529)*	*(0.603)*	*(0.538)*	*(0.540)*	*(0.537)*	*(0.536)*	*(0.525)*	*(0.902)*
Interaction (Asset Tangibility and Primary Fiscal Balance to potential GDP Counter-Cyclicality)	**-8.173*** **	**-8.220*** **	**-8.441* **	**-8.085** **	**-9.772*** **	**-8.321** **	**-8.639** **	**-7.993*** **	**-10.32** **
	(2.637)	*(2.627)*	*(3.963)*	*(3.259)*	*(2.960)*	*(3.133)*	*(3.579)*	*(2.660)*	*(4.337)*
Interaction (Asset Tangibility and Average Private Credit by Banks to GDP)	**-1.07**								
	(5.282)								
Interaction (Asset Tangibility and Average Domestic Banking Assets to GDP)		**0.503**							
		(4.519)							
Interaction (Asset Tangibility and Average Real long term interest rate)			**2.388**						
			(3.783)						
Interaction (Asset Tangibility and Average CPI Inflation)				**0.064**					
				(0.709)					
Interaction (Asset Tangibility and Average Short term Policy interest rate)					**-0.008**				
					(0.704)				
Interaction (Asset Tangibility and Average Fiscal Expenditures to GDP)						**0.025**			
						(0.268)			
Interaction (Asset Tangibility and Average Fiscal Revenues to GDP)							**0.066**		
							(0.269)		
Interaction (Asset Tangibility and Average Primary Fiscal Balance to potential GDP)								**-0.509**	
								(1.475)	
Interaction (Financial Dependence and Average Gross Government Debt to GDP)									**-0.067**
									(0.133)
Observations	523	523	490	523	482	523	523	523	347
R-squared	0.535	0.535	0.524	0.535	0.460	0.535	0.535	0.535	0.454

Note: The dependent variable is the average annual growth rate in labor productivity for the period 1980-2005 for each industry in each country. Initial Relative Labor Productivity is the ratio of industry labor productivity to total manufacturing labor productivity in 1980. Asset Tangibility is the median fraction of assets represented by net property, plant and equipment for US firms in the same industry for the period 1980-1989. Primary Fiscal Balance to potential GDP Counter-Cyclicality is the regression coefficient of the output gap when primary fiscal balance to potential GDP is regressed on a constant and the output gap for each country. Averages of control variables are computed over the estimation period 1980-2005. Interaction variables are the product of variables in parentheses. Estimated coefficients are in percentage. Standard errors -clustered at the country level- are in parentheses. All estimations include country and industry dummies. Significance at the 1% (resp. 5%; 10%) level is indicated by *** (resp. **; *).

Table 5: Taking into account the standard error of fiscal policy cyclicality estimates

Dependent variable: Labor Productivity Growth	(i)	(ii)	(iii)	(iv)
Log of Initial Relative Labor Productivity	**-2.553*****	**-2.546*****	**-2.530*****	**-2.514*****
	(0.513)	*(0.548)*	*(0.503)*	*(0.528)*
Interaction (Financial Dependence and Total Fiscal Balance to potential GDP Counter-Cyclicality)	**4.062*****			
	(0.991)			
Interaction (Financial Dependence and Primary Fiscal Balance to potential GDP Counter-Cyclicality)		**3.131*****		
		(0.631)		
Interaction (Asset Tangibility and Total Fiscal Balance to potential GDP Counter-Cyclicality)			**-10.66****	
			(3.652)	
Interaction (Financial Dependence and Primary Fiscal Balance to potential GDP Counter-Cyclicality)				**-7.567****
				(2.703)
Observations	523	523	523	523
R-squared	0.544	0.545	0.536	0.534

Note: The dependent variable is the average annual growth rate in labor productivity for the period 1980-2005 for each industry in each country. Financial Dependence is the median fraction of capital expenditures not financed with internal funds for US firms in the same industry for the period 1980-1989. Asset Tangibility is the median fraction of assets represented by net property, plant and equipment for US firms in the same industry for the period 1980-1989. Total (resp. Primary) Fiscal Balance to potential GDP Counter-Cyclicality is the coefficient of the output gap when total (resp. primary) fiscal balance to potential GDP is regressed on a constant and the output gap for each country. The interaction variable is the product of variables in parentheses. Estimated coefficients are in percentage. Standard errors are in parentheses. All estimations include country and industry dummies. Standard errors clustered at the country level. Estimations are based on the average for parameters and standard errors estimates, computed over 2000 OLS regressions using a fiscal policy cyclicality index randomly drawn from the empirical distribution estimated in the first stage regression. Significance at the 1% (resp. 5%; 10%) level is indicated by *** (resp. **; *).

Table 6: Using instruments for fiscal policy cyclicality

Dependent variable: Labor Productivity Growth	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)
Log of Initial Relative Labor Productivity	**-2.017***** *(0.568)*	**-1.984***** *(0.559)*	**-1.957***** *(0.524)*	**-1.942***** *(0.526)*	**-2.523***** *(0.364)*	**-2.500***** *(0.368)*	**-2.498***** *(0.340)*	**-2.472***** *(0.343)*
Interaction (Financial Dependence and Total Fiscal Balance to potential GDP Counter-Cyclicality)	**4.312**** *(1.852)*				**5.829***** *(1.948)*			
Interaction (Financial Dependence and Primary Fiscal Balance to potential GDP Counter-Cyclicality)		**4.019***** *(1.484)*				**4.534***** *(1.554)*		
Interaction (Asset Tangibility and Total Fiscal Balance to potential GDP Counter-Cyclicality)			**-15.73**** *(6.662)*				**-13.96**** *(6.025)*	
Interaction (Asset Tangibility and Primary Fiscal Balance to potential GDP Counter-Cyclicality)				**-12.36**** *(5.774)*				**-9.913**** *(4.288)*
Hansen J. Stat	**5.968**	**5.127**	**7.085**	**7.884**	**2.405**	**4.559**	**1.853**	**2.787**
p. value	*0.427*	*0.528*	*0.420*	*0.343*	*0.662*	*0.336*	*0.763*	*0.594*
Observations	417	417	417	417	523	523	523	523
R-squared	0.093	0.097	0.086	0.082	0.186	0.180	0.169	0.163

Note: The dependent variable is the average annual growth rate in labor productivity for the period 1980-2005 for each industry in each country. Initial Relative Labor Productivity is the ratio of industry labor productivity to total manufacturing labor productivity in 1980. Financial Dependence is the median fraction of capital expenditures not financed with internal funds for US firms in the same industry for the period 1980-1989. Asset Tangibility is the median fraction of assets represented by net property, plant and equipment for US firms in the same industry for the period 1980-1989. Total (resp. Primary) Fiscal Balance to potential GDP Counter-Cyclicality is the coefficient of the output gap when total (resp. primary) fiscal balance to potential GDP is regressed on a constant and the output gap for each country. Set of instruments for estimations (i)-(ii): GDP per capita, Total Government Expenditures to GDP, Imports to GDP, CPI inflation, nominal long term interest rate, nominal short term interest rate, private credit to GDP. Set of instruments for estimations (iii)-(iv): GDP per capita, Total Fiscal Balance to GDP, Primary Fiscal Balance to GDP, Imports to GDP, CPI inflation, real long term interest rate, real short term interest rate, private credit to GDP, financial system deposits to GDP. Instruments in estimations (i)-(iv) are averages over the period 1976-1980 except GDP per capita for which the 1980 value is considered. Set of instruments for estimations (v)-(vi): Legal origin (English, French, German, Scandinavian), District Magnitude, dummy for federal government. Set of instruments for estimations (vii)-(viii): Legal origin (German, Scandinavian), District Magnitude, dummy for federal government, index for civil liberties. The interaction variable is the product of variables in parentheses. Estimated coefficients are in percentage. Standard errors -clustered at the country level- are in parentheses. All estimations include country and sector dummies. Significance at the 1% (resp. 5%; 10%) level is by *** (resp. **; *).

Table 7: Testing for asymmetric effects

	Dependent variable: Below median output gap, labor productivity growth				Dependent variable: Above median output gap, labor productivity growth			
	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)
Log of Initial Relative Labor Productivity	**-3.394*****	**-3.383*****	**-3.305*****	**-3.295*****	**-1.663*****	**-1.663****	**-1.690*****	**-1.682*****
	(0.653)	*(0.706)*	*(0.625)*	*(0.671)*	*(0.547)*	*(0.563)*	*(0.557)*	*(0.559)*
Interaction (Financial Dependence and Total Fiscal Balance to potential GDP Counter-Cyclicality)	**5.212****				**4.511****			
	(2.052)				*(1.898)*			
Interaction (Financial Dependence and Primary Fiscal Balance to potential GDP Counter-Cyclicality)		**3.759****				**2.975****		
		(1.299)				*(1.049)*		
Interaction (Asset Tangibility and Total Fiscal Balance to potential GDP Counter-Cyclicality)			**-18.67*****				**-6.490**	
			(5.091)				*(4.317)*	
Interaction (Financial Dependence and Primary Fiscal Balance to potential GDP Counter-Cyclicality)				**-11.85*****				**-4.370**
				(3.583)				*(2.765)*
Observations	523	523	523	523	523	523	523	523
R-squared	0.494	0.494	0.496	0.491	0.457	0.454	0.443	0.443

Note: The dependent variable in estimations (i)-(iv) is the average annual growth rate in labor productivity for each industry in each country for the period 1980-2005 when the output gap was below historical median. The dependent variable in estimations (v)-(viii) is the average annual growth rate in labor productivity for each industry in each country for the period 1980-2005 when the output gap was above historical median. Initial Relative Labor Productivity is the ratio of industry labor productivity to total manufacturing labor productivity in 1980. Financial Dependence is the median fraction of capital expenditures not financed with internal funds for US firms in the same industry for the period 1980-1989. Asset Tangibility is the median fraction of assets represented by net property, plant and equipment for US firms in the same industry for the period 1980-1989. Total (resp. Primary) Fiscal Balance to potential GDP Counter-Cyclicality is the coefficient of the output gap when total (resp. primary) fiscal balance to potential GDP is regressed on a constant and the output gap for each country. The interaction variable is the product of variables in parentheses. Estimated coefficients are in percentage. Standard errors -clustered at the country level- are in parentheses. All estimations include country and industry dummies. Significance at the 1% (resp. 5%; 10%) level is by *** (resp. **; *).